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Status of the northern Gulf of St. Lawrence Iceland scallop (*Chlamys islandica*) stock - 1987

by

Marc Lanteigne and Leslie-Anne Davidson
Department of Fisheries and Oceans
Gulf Fisheries Center
Science Branch
Invertebrate Division
Molluscan Aquaculture/Assessment Section
P.O. Box 5030
Moncton, N.B., E1C 9B6

ABSTRACT

The northeastern Gulf of St. Lawrence Iceland scallop (Chlamys islandica) stock assessment was done by analysing data from an experimental survey, logbooks, landing statistics, port samplings and a questionnaire.

The 1987 survey and port sampling size frequency distributions have shown average sizes and percentage of prerecruits (scallops < 70mm) similar to the 1985 and 1986 values. The percentage of clappers (dead scallops with valves still attached) was lower than the 1986 value but was similar to 1985 percentage. These results suggest an overall stable population structure since 1985. However, the decrease of the annual catch/fishing boat from 8.8 t in 1980 to about 3.0 t from 1984 to 1986 may be of some concern, knowing that the fishing efficiency had increased substantially since 1980. The results suggest a decrease of the exploited biomass.

Management options are presented. They are directed at maintaining the effort at its current level and improving the quality and quantity of the information needed for stock assessment.

RESUME

L'évaluation de la population de pétoncles d'islande (Chlamys islandica) dans le nord-est du golfe du St. Laurent a été effectuée en analysant les données provenant d'une campagne d'échantillonnage, de journeaux de bord, de statistiques de débarquements, d'échantillonnages au port et d'un questionnaire.

Les distributions de fréquences de tailles de la campagne d'échantillonnage et de l'échantillonnage au port en 1987 ont montré des tailles moyennes et des pourcentages de prérecrues (pétoncles < 70mm) similaires aux valeurs de 1985 et 1986. Le pourcentage de pétoncles morts (avec coquilles encore jointes) était plus faible qu'en 1986 mais était similaire au pourcentage de 1985. Ces résultats suggèrent que dans son ensemble, la population possède une structure stable depuis 1985. Cependant, la diminution des captures annuelles par bateau de pêche de 8.8 t en 1980 à environ 3.0 t entre 1984 et 1986 met en évidence des problèmes, surtout si on considère que l'efficacité de pêche a augmentée de façon importante depuis 1980. Les résultats suggèrent une diminution de la biomasse exploitée.

Des options de gestion sont présentées. Elles visent à maintenir l'effort à son niveau actuel et à améliorer la qualité et la quantité d'information nécessaire pour l'évaluation des populations.

INTRODUCTION

Commercial scallop fishing activities in the Strait of Belle Isle began in 1969. Up to 1981, the fishing effort had been concentrated in the southern part of the Strait. In 1982, the fishing grounds had expanded to the middle of the Strait and by 1985 the entire Strait of Belle Isle had been explored.

The fishery is characterized by unpredictable fluctuations of effort and landing mainly controlled by socio-economical factors and changes of the fishing efficiency. The fishing gear has drastically evolved in technology and efficiency since the beginning of the fishery. This evolution of the scallop dredge and the discovery of new fishing grounds may explain part of the peak landings seen in the past.

In 1987, the study of the Iceland scallop resource was continued. A review of the results and their implication on resource status is presented in this paper.

MATERIALS AND METHODS

1 - Experimental survey

An experimental survey was conducted in the Strait of Belle Isle (Figure 1), from July 17 to July 25, 1987, to delineate the scallop fishing grounds. The sampling stations were randomly chosen to cover:

a) the same area surveyed in 1985 and 1986 (Lanteigne et al., 1986 and Lanteigne and Davidson 1987).

b) the area covered by the fishing squares reported in the 1985 and 1986 logbook returns.

When possible, the LORAN C coordinates of the sampling stations were recorded. Otherwise, the radar and landmarks were used to position the stations.

The sampling gear was a two bucket scallop dredge. Each bucket was 1.5 M wide by 0.4 M high. The bottom mesh of each bucket was made of stainless steel rings (64 mm diameter) joined with chain links. The top mesh was made of a courlene net (100 mm streched mesh). Each tow was made at 2.5 knots for 10 minutes.

For each tow, all the live scallops and the 'clappers' (dead scallops with valves still attached) were measured to the nearest millimeter. The data were used to plot size frequency distributions (3 mm size intervals). The percentage of clappers was calculated as a proportion of all scallops measured (live and dead). The percentage of prerecruits was calculated as a proportion of the live scallops < 70 mm shell height.

2 - Commercial port sampling.

Observers sampled commercial catches in fish processing plants. A port sample consisted of about 300 meats taken randomly from a fisherman's catch. The weight of each scallop meat was recorded to the nearest 0.1 g. Meat weights were converted to shell heights using the meat weight/shell height relationship equation calculated by Naidu et al. (1982):

$MW = 3.6 \times 10^{-6} \times L^{2.86}$
(from the allometric equation $MW = a \times L^b$)

where MW = meat weight in grams.
L = shell height in millimeters.
a and b are constants.

The shell height data were used to plot size frequency distributions (3 mm size classes).

3 - Logbooks and questionnaires

Logbooks were distributed to 37 fishermen with experimental fishing permits. Fishermen with licences did not receive logbooks as it is not mandatory for licence holders.

The logbook was designed to gather daily information on catch, fishing locations, and effort. The fishing locations were reported as "fishing squares" out of a numbered grid covering the Strait of Belle Isle (Appendix I). The data were used to calculate catch per unit of effort (CPUE, in kg of meat/m·h) for each fishing square reported.

A questionnaire was issued at the end of the fishing season to all fishermen with a licence or a permit. The questionnaire was aimed at providing information on the effort distribution throughout the Strait of Belle Isle.

The Strait was divided into sub-areas which match the fishing square contours (Figure 2) as outlined by Lanteigne and Davidson (1987). These sub-areas were arbitrarily chosen to facilitate the analysis of the logbook and questionnaire results.

4 - Landing Statistics

The Iceland scallop fishery of the northern Gulf of St. Lawrence is located in the statistical sub-districts 1, 47, 48, 49, and 50 (Appendix I). Only these sub-districts were considered for the different analyses. Landing statistics were used to calculate effort as number of fishing boats, and the average catch per boat (metric ton of scallop meat/boat) for each year. The catch/boat was calculated by dividing the total annual landing value by the number of boats.

Catches landed and recorded as live weight were transformed into meat weight by dividing the live weight by 8.3. The same conversion factor is used by the Statistical Branch to convert the landed meat weights into live weights.

RESULTS

1 - Experimental survey and port sampling.

A summary of the results from 1985 to 1987 is presented in Table 1. In 1987, a total of 7573 scallops (live and dead) were measured during the experimental survey. Shell height varied from 40 mm to 107 mm (Figure 3). Prerecruits represented 5.1% of all the live scallops measured, which is an increase of 24.4% and 15.7% from the 1985 and 1986 values respectively. The average size calculated from the 1987 survey was similar to the values calculated in 1985 and 1986. The percentage of clappers was 12.1% lower than the 1986 values.

Results of transformed port sampled meat weights into shell heights were similar to survey results in terms of average scallop size and percentage of prerecruits (Table 1). The only difference was the size range. Port sampling size range was narrower with less larger size scallops than in survey samples.

2 - Logbook and questionnaire.

Only two (2) fishermen participated in the logbook program by sending in their daily reports. This represent 5.4% of all the fishermen who received a logbook. CPUE's for each fishing sub-area reported are presented in Table 2.

The questionnaire was answered by 32.9 % of all the fishermen holding a scallop licence or permit (Table 3). The fishing effort distribution as reported from the questionnaire was different than the one reported in 1985 and 1986 (Table 4). The sub-area G, in which the fishing effort was low in 1985 and 1986, had the highest fishing effort in the Strait of Belle Isle in 1987. The increase of fishing effort in G resulted in a decrease in sub-areas E, H and J. An increase was also noted in sub-area A. However, most of the 1987 fishing effort was concentrated along the Labrador coast as in 1985 and 1986.

3 - Landing statistics.

Landings, number of active fishing boats and annual catch per boat are presented in Figure 4 and Table 5. Landings peaked in 1972, 1981 and 1985 but were absent from 1975 to 1978, as no landings were reported.

4 - Yield per recruit (Y/R).

Yield per recruit calculations, using the Thompson and Bell model, were presented by Lanteigne et al. (1986) for a range of fishing mortalities, natural mortalities and age at capture. Because the actual parameters describing the Iceland scallop fishery of the Strait of Belle Isle are still unknown, the Y/R were not caculated again. Details on the model and the methodology used are presented in the 1986 CAFSAC Res. Doc. 86/76 (Lanteigne et al., 1986).

DISCUSSION

The Iceland scallop fishery in the northern Gulf of St. Lawrence is charactarized by high fluctuations in landings and effort resulting from complex socio-economical factors (Naidu et al., 1982; Lanteigne et al., 1986). Initially considered as a complementary fishery when it started in 1967, the fishery is gradually gaining importance. Being a relatively young fishery, the fishing grounds, the fishing gear and the fishermen's strategies have changed considerably since 1967. Naidu et al. (1982) and Lanteigne et al. (1986) have tried to explain the landing fluctuations and to assess the resource in view of these changes. But, the lack of historical catch and effort, experimental survey and sea sampling data, and the incomplete biological information make it difficult to assess.

In previous CAFSAC documents (Lanteigne and Davidson, 1987; Lanteigne et al., 1986) the number of fishing days and the catch per day were calculated from the data provided by Statistical Branch. The calculation was assuming that one selling transaction represented one fishing day. This assumption is not valid knowing that most fishermen accumulate their catch over a number of days, sometimes exceeding five days. Because of this bias, statistical data were only used to calculate the total annual catch in t of meat/fishing boat. The results presented in this report show an increase of the annual catch/boat from 1978 to 1980 (Figure 4) which might have been the result of an expansion of the fishing grounds and/or a change in the fishing gear efficiency, as mentionned by Lanteigne et al., 1986. However, the peak of 8.8 t/boat in 1980 dropped to 1.8 t/boat in 1982. Since 1983, the catch/boat has remained relatively stable between 2 and 4 t/boat. This decrease and subsequent leveling of the catch/boat has taken place during a well documented phase of fishing ground expansion and increased efficiency of the fishing gear. If the exploited biomass were at a stable level during that phase of changes, better yields would have been expected. It is suggested that the increasing efficiency of the fishing gear is maintaining the present catch/boat level over an unstable or depleting biomass. Cautionary measures should be considered and the fishery should be monitored carefully for the next few years.

Most of the 1987 fishing activity was located along the Labrador coast, as it was the case in 1985 and 1986 (Lanteigne et. al., 1986; Lanteigne and Davidson, 1987). Changes in the effort distribution were within the fishing grounds previously exploited. The overall movement of the fleet may have resulted from fishermen trying to maintain their catches. The provisional statistical data for 1987 and the poor return of logsheets make it impossible to evaluate the present situation adequately.

In 1987, a small group of fishermen constructed and tried a new dredge that was supposedly more efficient, which they called "the Labrador dredge". After discussions with these fishermen and assuming that the 1988 effort will be similar to 1987, it is possible that the change to the new dredge may result in higher landings for 1988. More fishermen are expected to switch from the regular "Strait of Belle Isle dredge" to the new dredge in 1988. The efficiency and the selectivity of the dredge presently used and of the new dredge are unknown at this time. A change in fishing gear will certainly add more difficulties in assessing the resource.

As mentionned in a 1987 CAFSAC Research Document (Lanteigne and Davidson, 1987) more historical catch and effort data are needed. Data such as effort levels, dredge efficiency and selectivity, growth, natural mortality, and stock distribution are also needed to provide an assessment of the Iceland scallop stock. The same management actions as proposed in 1987 are proposed for 1988:

1 - The effort should be maintained at its present level by not allowing any additionnal licences or permits. In 1987, 17% of the fishermen with licences or permits were not active (were not fishing). These inactive fishermen constitute a latent effort which can increase the actual effort at any moment.

2 - The scallop dredge specifications should be standardized and any changes in specifications should be reported to the Science Branch so that an accurate evaluation of the effort can be made.

3 - The logbook should be mandatory for all fishermen with a scallop fishing licence or permit, and not only for permit holders.

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Table 1. Summary of results obtained from: A - experimental surveys, B - sea samplings, and C - port samplings conducted on the Iceland scallop resource in the Strait of Belle Isle.

A Year	Size Range (mm)	Number of Scallops *	% of Scallops <70mm	% of Scallops Clappers	Average Size (mm)	SD
1985	12-121	4500	4.1	3.8	85.5	8.4
1986	2-118	7800	4.3	6.6	84.7	8.7
1987	40-107	7573	5.1	5.8	84.5	8.7

B Year	Size Range (mm)	Number of Scallops *	% of Scallops <70mm	% of Scallops Clappers	Average Size (mm)	SD
1985	---	---	---	---	---	---
1986	51-109	2582	1.3	2.6	88.8	7.3
1987	---	---	---	---	---	---

C Year	Size Range (mm)	Number of Scallops *	% of Scallops ** <70mm	% of Scallops ** Clappers	Average Size (mm)	SD
1985	---	---	---	---	---	---
1986	---	---	---	---	---	---
1987	58-121	5479	4.7	---	84.2	8.6

* - for live and dead (clappers) scallops combined.
** - data from meat weights transformed into shell heights. Percentage of clappers cannot be calculated.

Table 2. Average CPUE's (kg of meat/m·h), and relative index of effort for each sub-area, calculated from the logbook data. The index of effort is expressed in percentage of the total number of fishing days reported in the logbooks.

SUB-AREA	1985 CPUE	1985 SD	1986 CPUE	1986 SD	1987 CPUE	1987 SD	% of the total number of fishing days reported in the logbooks * 1985	1986	1987
A	---	---	---	---	---	---	---	---	---
B	---	---	---	---	---	---	---	---	---
C	5.09	1.44	4.60	0.81	---	---	22.1	13.3	---
D	6.09	2.96	3.58	---	---	---	8.0	0.1	---
E	6.59	1.03	4.74	1.43	3.85	---	29.7	32.3	87.1
F	5.26	2.41	4.76	1.93	---	---	2.4	6.8	---
G	4.82	2.21	4.51	0.82	---	---	2.7	10.0	---
H	4.97	1.43	4.35	0.52	5.07	0.06	29.2	29.0	12.9
I	---	---	---	---	---	---	---	---	---
J	4.89	0.06	3.35	0.79	---	---	5.8	7.7	---

* The total numbers of fishing days reported in the logbook in 1985, 1986 and 1987 were 411, 867 and 31 days respectively.

Table 3. Number of fishermen, with permits or licences, active (more than one fishing day) and non-active, who answered the questionnaire.

Total number of scallop fishermen with permits and licences		Number of fishermen who answered the fishermen questionnaire		Total number of answers
		Active	Non-active	
Permits	39	8	2	10
Licences	107	15	23	38
Total	146	23	25	48

Table 4. Summary of the results from the questionnaire circulated to all fishermen. The percentage of fishermen who answered the questionnaire, and the distribution of the fishing effort expressed as percentage of the total number of fishing days reported are presented for 1985, 1986, and 1987.

SUB-AREA	% of fishermen per sub-area who answered the questionnaire (data reflecting homeports)			Distribution of the fishing effort as % of the total number of fishing days reported in the questionnaire (data reflecting fishing areas)		
	1985	1986	1987	1985	1986	1987
A	0	0	0	0.1	8.3	11.9
B	14.4	10.7	4.2	0	0	2.3
C	9.5	7.2	35.4	30.7	22.9	28.8
D	31.7	32.1	31.3	15.0	6.2	4.3
E	17.5	25.0	10.4	31.9	20.6	7.9
F	14.2	10.7	18.8	7.8	6.5	0
G	0	0	0	2.1	11.8	40.0
H	0	0	0	10.1	10.0	4.8
I	0	0	0	0	0	0
J	12.7	3.6	0	2.2	13.7	0

Table 5. Effort (fishing days) and catch per day, in kg of meat weigh for the C. islandica fishery in the northern Gulf of St. Lawrence (Strait of Belle Isle), calculated from landing statistics.

Year	Number of boats actively fishing	Annual catch per fishing boat (Kg of meat/boat)
1974	24	1104.2
1975	0	0 *
1976	0	0 *
1977	0	0 *
1978	0	0 *
1979	16	3056.3
1980	14	8800.0
1981	24	6933.3
1982	24	1579.2
1983	23	1756.5
1984	46	3326.1
1985	107	2225.6
1986	87	1010.4
1987	24	518.1 **

* - No fishing reported.
** - Provisional data.